Static Malware Analysis

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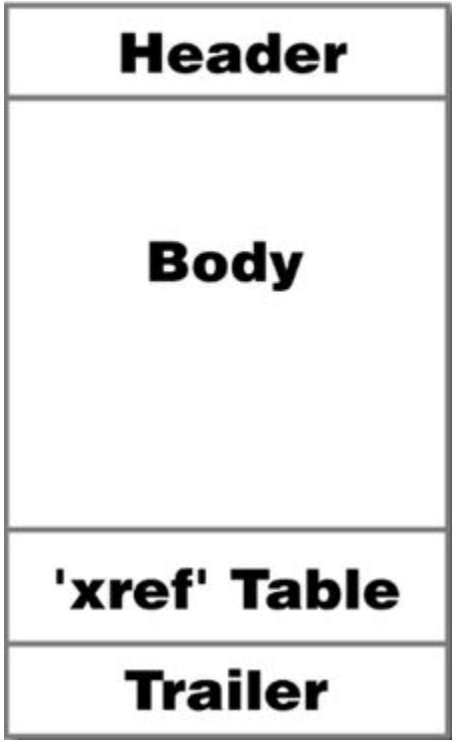
REMnux

Site: remnux.org

Analyzing PDF Files

Structure of a PDF file



PDF File Header

Irrespective of the PDF version, a PDF file starts with a header containing unique identifier for PDF and the version of the format such as %PDF-1.x where x ranges from 1-7.

File Body

In the body of the PDF document, there are objects that typically include text streams, images, other multimedia elements, etc. The Body section is used to hold all the document's data being shown to the user.

Cross-Reference Table

The cross-reference table contains information that permits random access to indirect objects within the file so that the entire file need not be read to locate any object.

File Trailer

The trailer of a PDF file enables a conforming reader to quickly find the cross-reference table and certain special objects. Conforming readers should read a PDF file from its end.

Static Malware Analysis of PDF files:

The static analysis within REMnux is usually done in 3 parts.

1. Identifying suspicious objects using **pdfid** tool in Remnux. Objects could be an image, javascript, forms, text contents etc.
2. Identifying the reference number or object ids (the numbers pointing to the objects of interest) using **peepdf** tool
3. Dumping the raw contents from the suspicious objects using **pdf-parser**. Once the contents of the objects are dumped we can then analyze through and use external threat intel tools to investigate further.

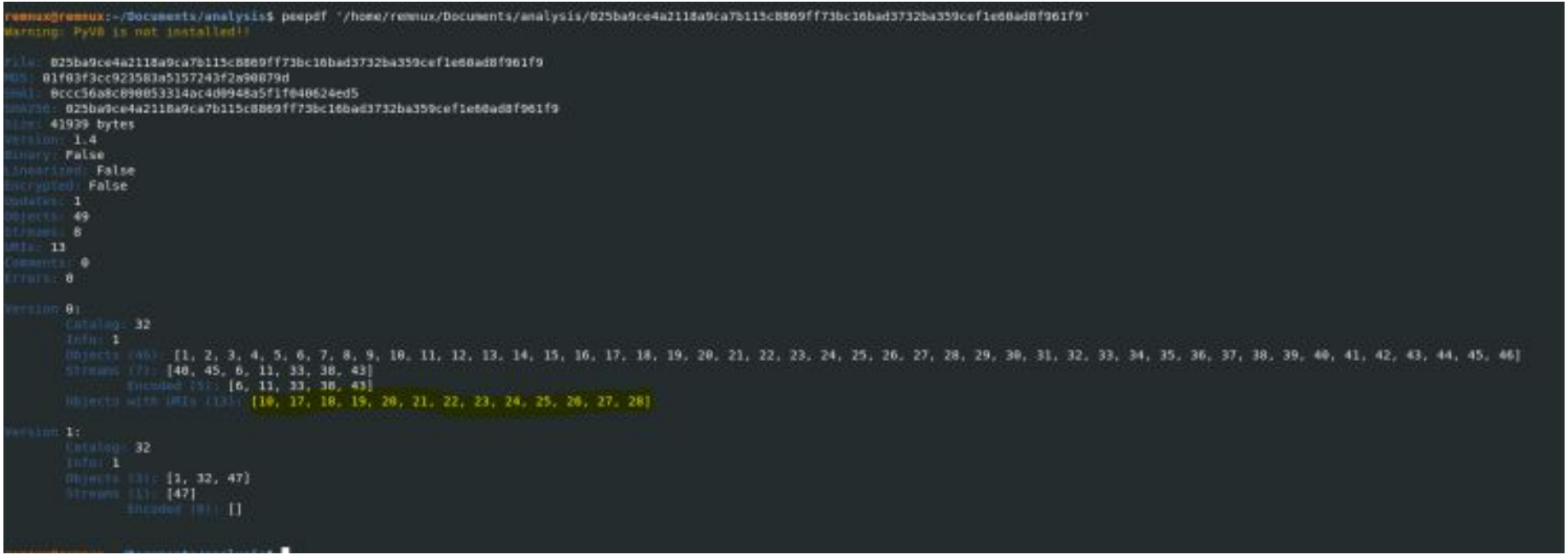
Identify Suspicious Objects Using pdfid

`pdfid.py <filename with full directory>`

```
remnux@remnux:~/Documents/analysis$ pdfid.py '/home/remnux/Documents/analysis/025ba9ce4a2118a9ca7b115c8869ff73bc16bad3732ba359cef1e60ad8f961f9
PDFiD 0.2.8 /home/remnux/Documents/analysis/025ba9ce4a2118a9ca7b115c8869ff73bc16bad3732ba359cef1e60ad8f961f9
 PDF Header: %PDF-1.4
 obj                    49
 endobj                 49
 stream                  8
 endstream               8
 xref                    2
 trailer                 2
 startxref               2
 /Page                   2
 /Encrypt                0
 /ObjStm                 0
 /JS                     0
 /JavaScript             0
 /AA                     0
 /OpenAction             0
 /AcroForm               0
 /JBIG2Decode            0
 /RichMedia              0
 /Launch                 0
 /EmbeddedFile           0
 /XFA                    0
 /URI                   26
 /Colors > 2^24          0
```

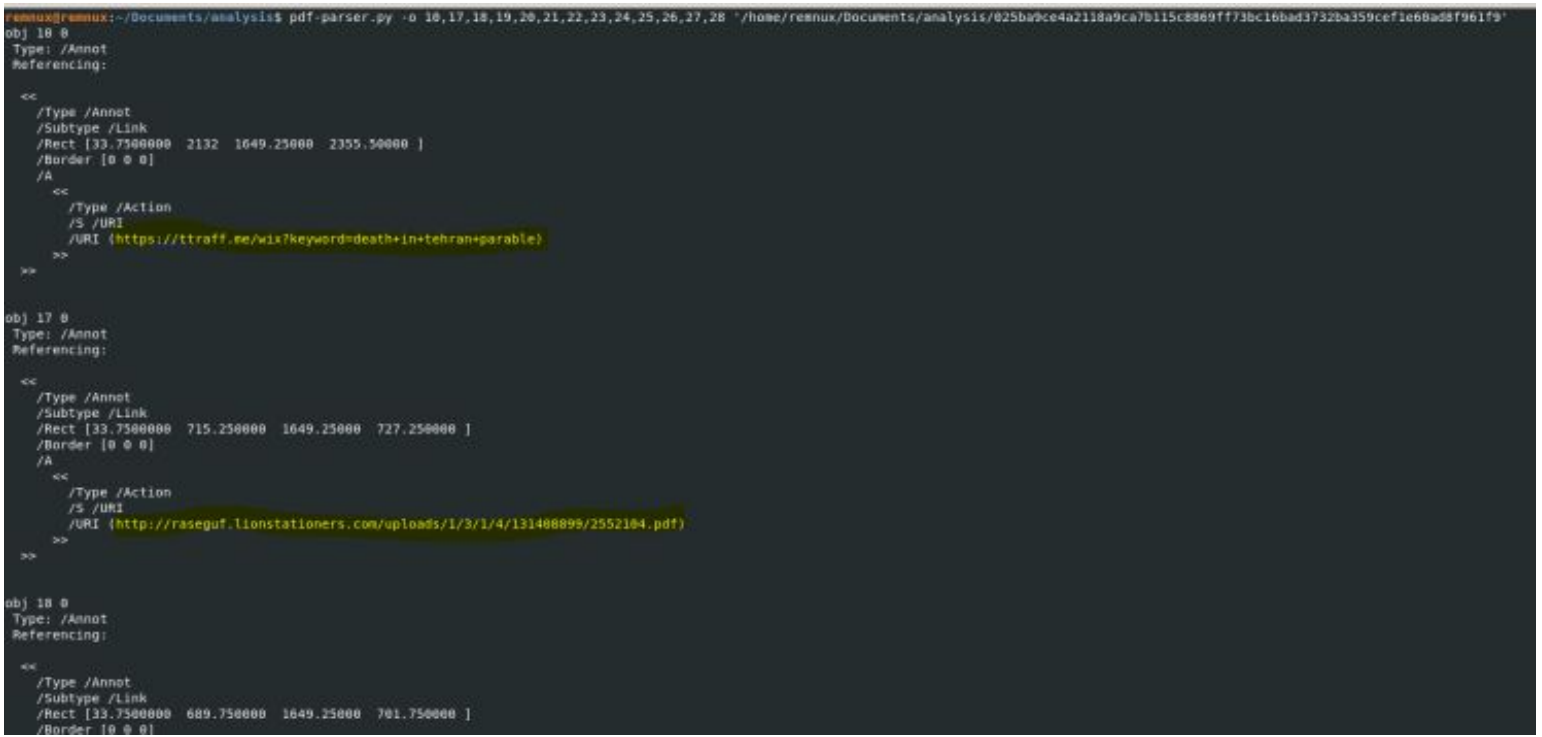
Identify the Reference Number or Object ids for the Identified Suspicious Object Using peepdf Tool

```
Peepdf <filename with full directory>
```



Dump the Raw Content from the Suspicious Object Using pdf-parser

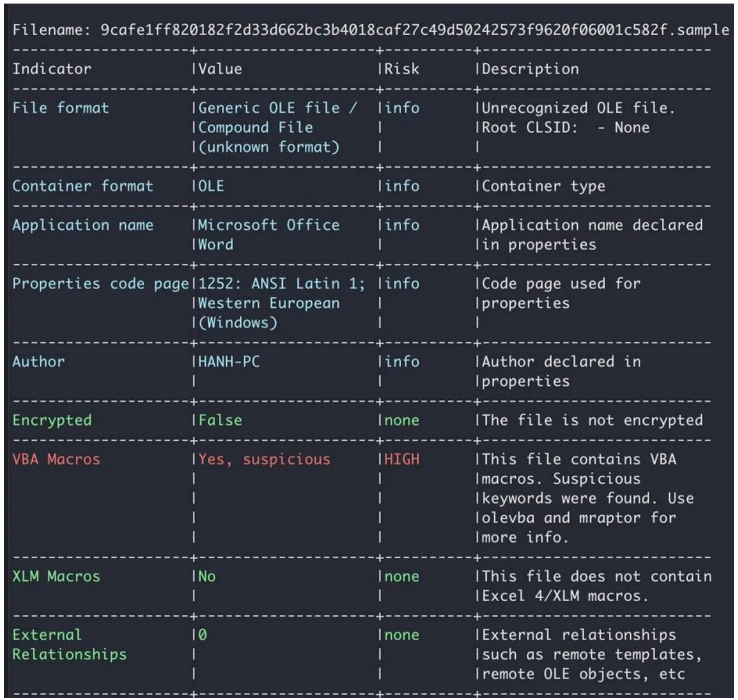
```
pdf-parser.py -o <#> --raw -f <filename with full directory>
```



Detecting and Analyzing Malicious Office Macros Using *oletools*

Detect VBA macros and embedded Flash objects

```
oleid <filename with full directory>
```



```
Filename: 9cafe1ff820182f2d33d662bc3b4018caf27c49d50242573f9620f06001c582f.sample
--------------------+--------------------+----------+--------------------------
Indicator           |Value               |Risk      |Description
--------------------+--------------------+----------+--------------------------
File format         |Generic OLE file /  |info      |Unrecognized OLE file.
                    |Compound File       |          |Root CLSID:  - None
                    |(unknown format)    |          |
--------------------+--------------------+----------+--------------------------
Container format    |OLE                 |info      |Container type
--------------------+--------------------+----------+--------------------------
Application name    |Microsoft Office    |info      |Application name declared
                    |Word                |          |in properties
--------------------+--------------------+----------+--------------------------
Properties code page|1252: ANSI Latin 1; |info      |Code page used for
                    |Western European    |          |properties
                    |(Windows)           |          |
--------------------+--------------------+----------+--------------------------
Author              |HANH-PC             |info      |Author declared in
                    |                    |          |properties
--------------------+--------------------+----------+--------------------------
Encrypted           |False               |none      |The file is not encrypted
--------------------+--------------------+----------+--------------------------
VBA Macros          |Yes, suspicious     |HIGH      |This file contains VBA
                    |                    |          |macros. Suspicious
                    |                    |          |keywords were found. Use
                    |                    |          |olevba and mraptor for
                    |                    |          |more info.
--------------------+--------------------+----------+--------------------------
XLM Macros          |No                  |none      |This file does not contain
                    |                    |          |Excel 4/XLM macros.
--------------------+--------------------+----------+--------------------------
External            |0                   |none      |External relationships
Relationships       |                    |          |such as remote templates,
                    |                    |          |remote OLE objects, etc
--------------------+--------------------+----------+--------------------------
```

Analyzing Identified Macros

`oledump.py <filename with full directory>`

```
remnux@remnux:~/Desktop/userform$ oledump.py userform.doc
  1:       113 '\x01CompObj'
  2:      4096 '\x05DocumentSummaryInformation'
  3:      4096 '\x05SummaryInformation'
  4:      4096 '1Table'
  5:     23902 'Data'
  6:       525 'Macros/PROJECT'
  7:        95 'Macros/PROJECTwm'
  8: M   10027 'Macros/VBA/ThisDocument'
  9:      7279 'Macros/VBA/_VBA_PROJECT'
 10: M   15955 'Macros/VBA/cowkeeper'
 11:       841 'Macros/VBA/dir'
 12: m    1158 'Macros/VBA/discord'
 13:        97 'Macros/discord/\x01CompObj'
 14:       291 'Macros/discord/\x03VBFrame'
 15:        98 'Macros/discord/f'
 16:       112 'Macros/discord/i01/\x01CompObj'
 17:      7476 'Macros/discord/i01/f'
 18:        68 'Macros/discord/i01/o'
 19:         0 'Macros/discord/o'
 20:     57094 'WordDocument'
```

```
remnux@remnux:~/Desktop/userform$ oledump.py -s 17 userform.doc
00000000: 00 04 2C 00 4A 0C 02 0C  FB 8D F8 00 02 00 00 00  ..,.J...........
00000010: 04 80 00 00 03 00 00 00  02 00 00 00 00 7D 00 00  .............}..
00000020: F8 1F 00 00 9E 02 00 00  00 00 00 00 00 00 00 00  ................
00000030: 01 00 00 00 FC 1C 00 00  00 01 68 6F 00 00 F4 1C  ..........ho....
00000040: E5 09 00 00 06 00 00 80  02 00 00 00 44 00 00 00  ............D...
00000050: 00 00 1C 00 CC 1C 00 80  70 69 6E 65 61 6C 00 00  ........pineal..
00000060: E3 0A 00 00 22 04 00 00  20 20 20 20 4F 45 4C 6F  ....".....    OELo
00000070: 3F 41 75 48 75 51 2E 42  73 44 4D 50 4F 45 67 34  ?AuHuQ.BsDMPOEg4
00000080: 46 41 65 48 27 4D 27 2E  73 67 69 48 75 4C 4B 6D  FAeH'M'.sgiHuLKm
00000090: 4F 45 6F 34 46 41 69 48  73 51 65 40 74 3D 66 40  OEo4FAiHsQe@t=f@
000000A0: 76 49 76 49 76 49 76 49  76 49 76 49 56 51 65 48  vIvIvIvIvIvIVQeH
000000B0: 3E 3F 51 73 3D 3D 3D 3D  4F 45 70 45 55 41 65 48  >?Qs====OEpEUAeH
000000C0: 4D 4E 64 45 65 2C 3D 73  4F 45 70 3D 41 49 4C 49  MNdEe,=sOEp=AILI
000000D0: 76 49 76 49 76 49 74 41  40 33 55 3F 40 33 55 3E  vIvIvItA@3U?@3U>
000000E0: 4D 4F 72 3D 60 4E 70 45  47 34 6D 4D 4E 55 50 3D  MOr=`NpEG4mMNUP=
000000F0: 60 3E 46 41 40 33 56 3F  3D 4D 27 2E 4E 3E 41 3E  `>FA@3V?=M'.N>A>
00000100: 4F 4C 2B 3F 4D 4F 72 3D  60 4B 69 42 73 44 67 41  OL+?MOr=`KiBsDgA
```

```
remnux@remnux:~/Desktop/userform$ oledump.py -s a -v userform.doc | grep pineal
periapt = discord.playbill.pineal.ControlTipText
```

Checking the file with olevba

`olevba <filename with full directory> OR olevba --reveal <filename with full directory>`

```
-------------------------------------------------------------------------------
VBA MACRO discord.frm
in file: userform.doc - OLE stream: 'Macros/VBA/discord'
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(empty macro)
-------------------------------------------------------------------------------
VBA FORM Variable "b'playbill'" IN 'userform.doc' - OLE stream: 'Macros/discord'
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
None
-------------------------------------------------------------------------------
VBA FORM Variable "b'pineal'" IN 'userform.doc' - OLE stream: 'Macros/discord/i01'
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
b'0'
```

Resources

- https://www.linkedin.com/pulse/static-malware-analysis-pdf-files-dummies-real-life-demos-raghul-c
- https://isc.sans.edu/diary/28894
- https://opensource.adobe.com/dc-acrobat-sdk-docs/pdfstandards/PDF32000_2008.pdf
- https://www.thecyberyeti.com/post/identifying-userforms-with-oledump-and-olevba
- https://sansorg.egnyte.com/dl/3ydBhha67l